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THE EFFECT OF BEHAVIORAL SKILLS TRAINING FOR DENTAL HYGIENE STUDENTS ON TREATMENT OF SPECIAL NEEDS PATIENTS DURING DENTAL CARE PROCEDURES

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by

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Approved by:

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MAJOR PROFESSORS: Dr. Ruth Anne Rehfeldt & Dr. Ronda R. DeMattei

This study assessed the effect of Behavioral Skills Training (instructions, modeling, rehearsal, and feedback) using a multiple baseline design to train 3 dental hygiene students to implement basic behavioral procedures (picture schedules, differential reinforcement, contingent escape, escape extinction, and least-to-most prompting) to manage and prevent challenging behavior during dental care procedures on special needs patients. The study took place in a mobile school-based dental clinic set up within 4 special schools. Training consisted of one group training session and several *in-vivo* training sessions. After training, participants' performance in the absence of feedback was assessed. Data show that participants performed less than 35% of steps correctly before receiving the training package and quickly reached criteria during training sessions. Results suggest that Behavioral Skills Training could be used to increase skills during one 3-hr class period, with further increases in skills to over 90% accuracy after some follow-up *in-vivo* practice and feedback.

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INTRODUCTION

Oral Health Care Needs of Individuals with Developmental Disabilities

Dental care is consistently listed as one of the top needed services by parents for their children with disabilities of all ages (DeMattei, Cuvo, & Maurizio, 2007). According to Charles (2010), a report by the Maternal and Child Health Bureau (MCHB) states that children with special health care needs (SHCN) are nearly "twice as likely to have unmet oral health care needs as their peers without special health care needs" (p. 84). (SHCN is defined as "those who have or are at risk for chronic physical, developmental, behavioral, and emotional conditions and who also require health care and related services of a type or amount beyond that required generally by children" [Charles, p. 84].) More important, among children with special needs, dental care is the leading unmet health care need (Marshall, Sheller, Williams, Mancl, & Cowan, 2007).

Cumella, Ransford, Lyons, and Burnham (2000) cited several studies which reported the dental health of adults with intellectual disability (ID). These studies identified many oral problems such as high prevalence of treated and untreated dental caries (cavities) and gingival disease, and poor oral and denture hygiene. Cumella and colleagues' sample of 50 adults with ID in England compared these adults to average adults in England. Adults with ID were worse off than average adults in terms of number of decayed teeth (untreated caries; 2.9 compared to 1.0, respectively) and missing teeth (8.4 compared to 7.6, respectively). It was also noted that 58% of participants had poor oral hygiene in terms of visual criteria alone. Likewise, Tesini and Fenton (1994) cited that children with ID are least likely to have "good" oral hygiene when compared to

those with other disabilities. Tesini and Fenton also cited high rates of periodontal disease in individuals with Down syndrome.

Klein and Nowak's (1998) review found that those with an autism spectrum disorder (ASD) have more oral health problems than those who did not have an ASD. Tesini and Fenton (1994) suggest that many people with ASD exhibit damaging oral habits such as increased bruxism (teeth grinding), tongue thrusting, and self-injurious behavior (SIB) that may affect the teeth. "Parental reports indicate that between 20 and 25 percent of children with autism brux during sleep" (Friedlander, Yagiela, Paterno, & Mahler, 2006, p. 1524). These oral habits may contribute to oral health problems found in individuals with ASD. On the other hand, Klein and Nowak also found that, of the authors who investigated the oral health and dental needs of individuals with an ASD, more authors found the oral health of individuals with ASD to be "not remarkably different from nonautistic individuals" (p. 314).

DeMattei and colleagues (2007) provided oral assessments to 55 participants with an ASD or another developmental disability. In agreement with many of the investigations reviewed in the Klein and Nowak (1998) study, oral conditions in general were not significantly different between children with an ASD and children with other developmental disabilities, but the authors found that children with another developmental disability had significantly more oral injuries than children with an ASD, 63% and 26%, respectively (DeMattei et al.). This study also found that 85% of children with an ASD and 94% of children with another developmental disability displayed visible plaque while 62% of children with an ASD and 88% of children with another developmental disability displayed visible gingivitis (DeMattei et al.). These numbers are quite high, but averages for typically developing children are not given for comparison.

Related to the issue of oral health is the high rate of uncooperative behavior displayed by individuals with ASD during dental visits. DeMattei et al. (2007) reported that half of their ASD participants displayed oral defensiveness (not cooperating with instructions) during a simple oral assessment. While most people do not enjoy having others look in their mouth or having dental procedures, aversion to oral procedures may be amplified for children with developmental disabilities. Loo, Graham, and Hughes (2009) statistically analyzed dental charts of over 700 individuals (half had an ASD) and found that significantly more patients with autism showed uncooperative behavior during dental visits than unaffected patients. Age was also significantly related to uncooperative behavior—individuals with an ASD were more uncooperative the younger the chronological age. This conclusion was also found by Marshall and colleagues (2007). Marshall et al. additionally found, like DeMattei et al. and Loo et al., that 65% of the child dental patients with ASD were considered uncooperative when rated by the dentist with the Frankl behavior rating scale used to quantify patient behavior.

The facts listed above seem to suggest that those with developmental disabilities appear to need dental services more than their typical peers. In addition to presenting the unmet dental needs of children with SHCN, the literature documents the need for better didactic and clinical training of dental students, dental hygiene students, and practicing oral health care providers. Additionally, a standard was created in 2004 that required graduates of accredited dental programs to be competent in "assessing the treatment needs of patients with special needs" (Krause, Vainio, Zwetchkenbaum, & Inglehart, 2010, p. 1180). Furthermore, Tesini and Fenton (1994) remind us that as of 1990, the Americans with Disabilities Act "requires that private dental offices serve persons with disabilities and that dentists make reasonable modifications to facilitate access to dental offices" (p. 495). Therefore, patients with disabilities need dental care,

dental program graduates must have knowledge and experience in working with individuals with special needs, and to ensure compliance with the ADA, providers must become competent in the delivery of oral care services to this underserved population.

Education and Attitudes of Oral Health Professionals Regarding Treating Individuals with Developmental Disabilities

Research shows there is a lack of oral health providers who are willing and qualified to care for children with SHCN. Numerous studies document the educational experiences, attitudes, and opinions of oral health care providers. These studies provide us with insight into the educational experiences and whether students feel competent in treating "patients with special needs." Wolff, Waldman, Milano, and Perlman (2004) surveyed nearly 300 dental students at five dental schools for their experiences with and attitudes toward individuals with ID. Only 50% of students reported having any clinical training with individuals with ID with only about 32% of students having more than 5 hours of instruction devoted to care for individuals with ID. Most importantly, about 60% of students reported having little to no confidence that they could provide care to this population and about 75% of students reported little to no preparation in providing care to this population. Not surprisingly, the majority of general dentists (89%) surveyed by Dao, Zwetchkenbaum, and Inglehart (2005) also felt that their education had not prepared them to treat patients with special needs. Therefore, most dental health professionals do not feel that their training prepared them to treat individuals with disabilities, but those who did receive experience in providing care to individuals with disabilities felt more confident that they could provide care to this population, and felt more prepared to provide care to this population. This is really important because the dentist, not dental hygienists or dental assistants of a dental office, are typically the main decision-makers of who will receive care at the office. However,

while the aforementioned studies were not likely affected by the 2004 standard, more recent studies have been conducted to assess the effect the standard has had on dental education programs.

Krause et al. (2010) investigated how dental schools have responded to the 2004 standard as well as which disabilities were being addressed by educational programs. Educational programs seem to be, at least, attempting to meet the standard. The average amount of time dental students spent learning through classroom-based material about working with individuals with special needs was 23 hours, ranging from 8 to 148 hours (Krause et al.). Seven of the eight dental schools with special clinics for patients with special needs reported that "all students must rotate through this clinic on a mandatory basis; the remaining school responded that only certain students are selected to provide care in this clinic" (Krause et al., p. 1185). Developmental disabilities such as Down syndrome, ASD, and ID were the most frequently addressed disabilities in educational programs, according to Krause and colleagues.

Common Techniques Used to Manage Behavior in Dental Environments for Individuals with Developmental Disabilities

Utilization of the appropriate behavior management approach by the oral health provider is a concern for parents and caregivers of children with SHCN. Review of the literature suggests the behavior management techniques that the majority of dental program students are being taught are not behavior-analytic in nature. In the Krause et al. (2010) study, 22 schools reported the techniques taught to manage behavior. All but one school reported teaching their students the Tell-Show-Do technique. Also, the majority of programs (over 70%) reported teaching their students to use protective restraints and nitrous oxide (aka. laughing gas) when working on patients with special needs. Only one of the 22 schools reported teaching "specific behavior

management techniques" (p. 1183). Not surprisingly, behavior management techniques used by dentists have been found to vary depending on the age of the dentist and the dental school from which the professional graduated (Peretz & Gluck, 2002).

In 1990, Allen, Stanley, and McPherson found that Tell-Do-Show and noncontingent prizes at the end of the visit were (reportedly) used most frequently as behavior management techniques by pediatric dentists during restorative dental treatment. (This was with all types of children.) Weil, Bagramian, and Inglehart (2011) found that 90% of respondents who actually provide dental care for individuals with ASD use noncontingent rewards at the end of the visit and 86% use the Tell-Show-Do technique "often." The next most frequent behavior management techniques used were, in order of popularity, verbal reprimands, sedation, parents in the operatory, restraint, and the Hand Over Mouth Exercise (HOME; described below; Allen et al., 1990). Weil and colleagues reported that 91% of respondents allowed parents in the operatory, 75% of respondents used some form of sedation, and 76% of respondents used some sort of restraints on patients with ASD either sometimes or often (53% reported using a papoose board or physical restraints, 57% reported having dental assistant(s) restrain a child, and 76% reported having a parent restrain a child). Behavioral techniques such as live and filmed modeling and contingent rewards ranked no higher than 8th most popular as management techniques (Allen et al., 1990). It is clear that the most highly preferred techniques by pediatric dentists were those that had a long history of use in the field, even if they were not backed by efficacy data. While Tell-Show-Do and noncontingent prizes are much less invasive than reprimands, sedation, restraint, and HOME, they are not as likely to be successful with children with developmental disabilities. This is because many of these children do not have the verbal repertoires to

understand what the dentist is telling them to do and delayed reinforcement may not be powerful enough to increase appropriate behavior.

Oueis, Ralstrom, Miriyala, Molinari, and Casamassimo (2010) discuss the HOME (hand over mouth exercise) and alternatives for the technique after it was eliminated. HOME was considered acceptable to use "for an uncooperative child who presented with hysterical behavior. The dentist's hand was placed gently over the child's mouth, and behavioral expectations were explained calmly to the child" (p. 223). This technique was included in the American Academy of Pediatric Dentistry (AAPD) guidelines. A similar technique, the HOMAR (hand over mouth with airway restriction), was never included in the guidelines; it includes closing the nostrils of the child as well as covering the mouth. The HOME was considered controversial for many years and recently its use has declined greatly (Oueis et al.). A 2004 study showed that 79% of AAPD members did not use the HOME. Weil and colleagues (2011) found that 93% of their respondents never used the HOME. It actually seems that the elimination of the HOME technique from the guidelines was overdue since 54% of dental programs taught HOME "as an unacceptable technique" (p. 223) by 2004 while only 28% of programs taught HOME as an acceptable technique. In 2005, parents rated the HOME as the least acceptable behavior management technique. The alternatives to HOME that were briefly discussed were voice control, papoose board, minimum/moderate sedation, deep sedation, and general anesthesia. A study with 704 respondents found that the most common first and second choices as alternatives to HOME for managing hysterical behavior were voice control and minimum/moderate sedation, respectively (Oueis et al.).

Many dental care professionals and researchers have discussed current methods used to treat "anxious" and uncooperative children with and without autism (Buchanan & Niven, 2003;

Kemp, 2005; Klein & Nowak, 1998; Loo et al., 2009). The most common techniques used to handle uncooperative patients with ASD identified by Loo and colleagues were general anesthesia, protective stabilization (which seems to consist of blocking and/or restraint), and conscious sedation. Kamen and Skier (1985) found that 20 of the 26 participants with ASD who had been to the dentist had received some sort of premedication, sedation, or anesthesia, while only one participant did not receive any of these, and the rest of the participants' parents did not respond to the question.

Two other techniques used to treat "dentally anxious children" are termed blunting, or trying to distract the anxious individual, and monitoring, or giving information about the procedures (Buchanan & Niven, 2003). These techniques that require fairly complex verbal understanding may not work well on a low-functioning child with a developmental disability. Nonverbal forms of blunting may be useful for children with developmental disabilities, but Buchanan and Niven report that previous studies have found that "distraction is one of the least used [pediatric] management techniques."

Suggested Techniques for Treating Individuals with Developmental Disabilities

Many published articles give advice to dentists in reference to techniques to use with individuals with special needs. However, not all of these articles appear to be based on research of the techniques. For example, Friedlander et al. (2006) advise dentists to exhibit compassion to individuals with autism and their families, to allow parents or aides in the operatory with the child, and to use a dental mouth prop to help the patient keep their mouth open. Kamen and Skier (1985) also gave advice that they claimed "seems to work" with children with ASD—giving instructions in a sing-song way (p. 21). One dental professional suggests that the "Tell-Show-Do" technique is important to use with all patients with special needs, but not to go into great

detail about the procedures or concepts; instead, a dental professional should focus on skills that the patient can actually use (Elliott-Smith, 2011).

Friedlander and colleagues (2006), as well as other authors (i.e., Raposa, 2009), suggest setting up preliminary office visits in order to obtain medical histories, assess capabilities, and gauge the extent of dental disease before entering the operatory and doing an oral exam or cleaning. It is unclear and unlikely, however, that these suggestions were backed by research. In fact, Allen, Hutfless, and Larzelere (2003) found that parents' ratings of their children's behavior outside of the clinic was not predictive of the child's disruptiveness while in the dental operatory. More recently, Meurs, Rutten, and de Jongh (2010), found that receiving prior information about patients with intellectual disabilities before the oral examination had no effect on the cooperation scores of the patients, suggesting that dentists were no more prepared to facilitate cooperation with patients with disabilities when provided with background information about the patient than when no background information was provided. Therefore, assessing a child's behavior prior to entering the dental operatory may not be useful, as some claim.

Kamen and Skier (1985) were against the use of physical restraints as they claim it is "unwarranted and will invariably prove unsuccessful" (p.21), but suggested the use of sedation or tranquilization after an attempt to treat the child routinely has been made. Tesini and Fenton (1994) also took a stance against restraint, suggesting that it should only be used when absolutely necessary, consent must be given before it is employed, it should not be used as punishment or solely for staff convenience, it should not cause physical injury, and it must be documented in the patient's treatment record. Peretz and Gluck (2002) have compiled a review of the use of restraint in pediatric dental treatment. The issues of documentation, assuring no physical injury, and obtaining consent are mentioned, as well as an assertion that parents must be provided with

detailed explanations of the restraint that may be used as well as all other behavior modification techniques that the dentists may use before any techniques are implemented (Peretz & Gluck). Finally, while restraint has shown to be successful in assisting dental professionals to complete treatments and examinations, Peretz and Gluck suggest that research be conducted on the long-term psychological impact of restraint on patients, as none existed at the time of their review.

Charles (2010) suggested different techniques and hints for use when working with different developmentally disabled populations. When working with children with ADHD, he suggests providing frequent breaks and reinforcement for appropriate behavior (possibly using tokens to exchange for a larger reward at the end of the visit). When working with children with ID, he suggests keeping waiting time and appointments short, communicating with the patient according to his/her mental age and with visuals, reinforcing frequently with praise, allowing additional visits to the office prior to the exam so the child can become familiar and more comfortable with the environment and staff, and social stories/picture books prior to the visit and in waiting room. Finally, when working with children with ASD, Charles suggests the use of visual schedules and social stories to make trips to the dentist more successful, using Tell-Show-Do, knowing the child's developmental/mental age and communicating with them accordingly, discussing behavioral problems with parents prior to visit, getting predictions from parents about the child's cooperation, reinforcing cooperative behavior after each step, and ignoring uncooperative and inappropriate behavior. Bäckman and Pilebro (1999) also suggest using a picture schedule about visiting the dentist for children with ASD.

Applied Behavior Analysis and Dental Environments

As individuals in the dental professions are attempting to find new effective and efficient ways to treat noncompliance and other challenging behavior in order to fulfill the oral care needs

of individuals with developmental disabilities, some are looking towards behavior analytic methods. Kuhn and Allen (1994) suggest contingent distraction, live modeling, and contingent escape as methods to manage challenging behavior in dental environments. As of the time it was written, these techniques were not yet researched in dental environments, but the authors suggested that the prior research on these techniques show that they are easy to learn and effective.

Marshall and colleagues (2007) studied predictors of cooperation with dental appointments in patients with ASD. These authors stated that "child participation with tooth-brushing was significantly predictive of cooperation" with children who independently brushed their teeth or did so with assistance being more cooperative during oral procedures than children whose parents brushed their teeth for them (Marshall et al., p. 372). This study also reported that parents of 70% of the 108 children with autism in the study either brushed their child's teeth for them or assisted with brushing. Kamen & Skier (1985) discussed surveys concerning oral health sent to parents of children and young adults with autism by the Nassau Suffolk Chapter of the National Society for Autistic Children in 1980. Parents of 28 individuals with autism responded. Twenty-three of the children brushed their own teeth, none of the children could floss their teeth, and one had never been to a dentist. While repeated dental visits does not appear to increase cooperation with procedures (Marshall et al.), Luscre and Center (1996) and Kemp (2005) both asserted that repeated practice and massed practice (many repeated practice sessions one immediately after another) over a short period of time will lead to more successful outcomes than being only exposed to one treatment or practice spaced out across long intervals.

While there is a great need for effective and efficient procedures for handling children with autism during dental procedures, if parents can effectively clean their children's teeth when

they are young and then teach these children to effectively clean their own teeth when they have the abilities, there would be a lesser need to visit oral care providers in the first place. Routine oral exams are still necessary and every attempt to obtain routine oral exams for children with autism should be made, but more intrusive cleaning and restorative procedures will be less necessary with more effective everyday tooth-brushing. Alternatively, a child with autism may engage in behaviors to escape tooth-brushing. Cuvo et al. (2010) reported that several of their participants exhibited escape and avoidance behavior during tooth-brushing at home. Over time, a lack of clean teeth could lead to cavities and other oral diseases.

Pilebro and Bäckman (2005) attempted to teach 14 children with ASD to brush their teeth simply by using a series of pictures exhibiting the proper steps (picture models). After 18 months, the picture intervention was successful in teaching five of the children to brush their teeth and they no longer needed the pictures. Of the remaining nine children, two children still needed the pictures in order to brush their teeth, four children used the pictures occasionally as a reminder/support, two children did not understand the pictures, and one child could not use the pictures according to the planned intervention.

Systematic desensitization is a very commonly used procedure to increase compliance to dental procedures for individuals with disabilities. This has shown to be a useful procedure for individuals who do not even allow dental tools near their mouth. Luscre and Center (1996) used desensitization and video peer modeling, along with reinforcement, in order to increase the number of steps completed toward a dental exam with children with autism. These procedures were used as a package and were effective for increasing the steps completed toward a dental exam for all participants; all three participants completed a dental exam in an analog setting and two participants completed a dental exam in a real dental setting as well. Conyers et al. (2004)

investigated desensitization and video modeling to increase compliance in adults with ID. Desensitization was effective for increasing compliance with dental procedures for all participants while video modeling only increased compliance with dental procedures for one out of three participants. Altabet (2002) used a systematic desensitization procedure for individuals with ID. Both treatment and control groups showed a fair amount of increased compliance; however, completion of treatment typically lasted 3 months. Repeated exposure/maturation may be the cause of the improvement for both groups, however, because the study did not clearly rule out extraneous factors. Groups were not randomly assigned and the treatment group was worse during baseline than the nontreatment group, suggesting a selection bias. While program participants improved on average, restraint and sedation were only eliminated in 20% and 10% of individuals, respectively. This was not statistically significant between groups nor does this difference appear to have clinical significance if the systematic desensitization treatment takes about 3 months. While some clients may not emit any compliant behaviors with the best of behavioral technology aside from systematic desensitization, it is likely that with correct use of differential reinforcement and escape extinction, many clients will have some success at dental visits. This is much less time consuming and much more cost-efficient than a 3 month systematic desensitization program.

Cuvo, Godard, Huckfeldt, and DeMattei (2010), like many other researchers, used a treatment package (theirs containing a host of behavior analytic methods) to increase compliance with an oral assessment. This treatment package included stimulus fading (i.e., fading in aversive stimuli), preference assessment, priming video model, various prompts, distracting stimuli, escape extinction, and differential reinforcement. While the effect of each component of the package is unknown, this treatment package as a whole was successful for increasing compliance

for all children with ASD who participated. Allen and Stokes (1987) implemented a reinforced practice procedure with contingent praise, rewards, and escape for cooperative behavior (defined as lying still and quiet and complying with instructions) during practice dental procedures with the sights and sounds of dental tools, but no actual dental work was done. The participants in this study were five children under the age of 6 who displayed "excessive levels of disruptive behavior" (p. 382) during previous dental visits. This combination of procedures was very effective in decreasing the disruptive behavior of all children and the posttreatment ratings of the children's behaviors by dental professionals were much more cooperative and relaxed than baseline ratings.

While practice procedures for the child were shown to be effective, Allen, Loiben, Allen, and Stanley (1992, p. 630) stated that practice sessions may be "cumbersome and impractical for practicing dentists" as most dentists are paid per procedure and extra time spent with each client means less money made. To solve this problem, Allen et al. (1992) eliminated practice visits for the children and instead taught the dentist to implement contingent escape and praise for typically developing children who displayed disruptive behavior during previous dental visits. Escape extinction was also implemented by the dentist in the form of continuing the procedure or holding the dental instruments in place during disruptive behavior and waiting for appropriate behavior to remove the instruments. Contingent escape and escape extinction effectively reduced the children's disruptive behavior and did not increase the time devoted by the dentist to implementing behavior management procedures over baseline levels (time was actually slightly decreased). O'Callaghan, Allen, Powell, and Salama (2006) taught a dentist to implement noncontingent escape during dental procedures to decrease the disruptive behavior of typically developing children. The authors chose this procedure because contingent escape requires

training and vigilance by dentist and maintaining the dentist's adherence to program may be challenging. Thus, noncontingent escape requires little response effort and a concealed electronic timer can be worn by the dentist. Results showed large decreases in disruptive behavior for four of the five participants. However, there is always the possibility of strengthening problem behaviors due to the lack of control over what the child is doing when a (likely reinforcing) break is provided.

Contingent escape and escape extinction have been successful in many applications, including increasing compliance with dental procedures and decreasing disruptive behaviors (see above). If children deemed "extremely disruptive" (Allen & Stokes, 1987, p. 386) during restorative dental treatments can be effectively managed with negative and positive reinforcement in the forms of temporary contingent escape and praise and tangible rewards, these simple procedures should work for all dental procedures. These procedures should work for children with developmental disabilities due to their foundation as behavioral principles. Dental professionals could be taught how to implement escape extinction and escape from the task contingent upon appropriate behavior. Behavioral skills training (often called BST) could be used to teach dental professionals how to effectively use these procedures during all dental procedures.

Applied Behavior Analysis and Medical Examinations

Medical and dental exams are fairly similar, with new environments and people, the professional dressed in different clothing and wearing gloves and masks, and unusual procedures being performed on the child. Noncompliance of children with disabilities is also a large problem with medical procedures (Riviere, Becquet, Peltret, Facon, & Darcheville, 2011). In this way, successful behavior analytic treatments to increase children's compliance in medical

environments may also be useful in dental environments. One procedure that has not yet been used for dental procedures but which has been shown to be successful in increasing cooperation in uncooperative children during medical examinations and treatments is the high-probability request procedure. A recent example comes from the research of Riviere et al. The high-probability (high-*p)* request procedure precedes a request that has a low probability of compliance with several (usually about three) requests that have a high probability of compliance. In the Riviere et al. study, parents tested a list of possible high-*p* requests for five days until a list of requests that occasioned 80% compliance or greater were formed. A high-*p* request sequence of three requests was then presented to the child before a low probability request by the child's mother, and then eventually by a medical professional in the child's home. The high-*p* request procedure was successful in gaining the children's compliance on the low probability requests during the medical examination. It seems important to note that medical professionals were able to carry out medical examinations without medication by using the high-*p* request sequence. Also, Riviere et al. suggest that parents may find the high-*p* procedure to be easier to implement or more preferable than other behavioral treatments because it has fewer negative side effects, such as increased problem behavior.

The one thing that seems to be missing from the Riviere and colleagues (2011) study, however, is the procedure being used within the medical setting. This procedure, along with the procedures that have been shown effective in dental environments, could easily be used by medical and dental professionals in their respective settings. BST would likely be an effective and efficient way to train dental staff (and medical staff) to use any of these behavioral procedures with children with developmental disabilities in dental environments (and medical environments) as part of their typical examination and treatment protocols.

Behavioral Skills Training

Behavioral skills training (BST) packages have been used to train implementation of a myriad of procedures. A few of these procedures include the picture exchange communication system (PECS; Rosales, Stone, & Rehfeldt, 2009), discrete-trial teaching (DTT; Lafasakis & Sturmey, 2007; Sarokoff & Sturmey, 2004), natural language paradigm (NLP; Seiverling, Pantelides, Ruiz, & Sturmey, 2010), and guided compliance (Miles & Wilder, 2009), among many others. All of the studies mentioned have shown that behavioral skills training as a package has been effective in training individuals to implement these procedures. The components of behavioral skills training are typically some combination of instructions, modeling, rehearsal, and feedback.

A notable study that utilized BST is Rosales and colleagues (2009). Rosales et al. used an instructional video, written and verbal instructions, live modeling, rehearsal, and feedback to train participants to implement the first three phases of PECS training. Steps used for training each phase of PECS in the Rosales et al. study were as follows: participants received the task analysis checklist and the trainer vocally described each step, the trainer and a confederate modeled correct implementation of each step of the task analysis, the participant then rehearsed correct implementation of each step of the task analysis with the confederate, and the trainer provided corrective or approving feedback of the participant's performance. Modeling, rehearsal, and feedback were repeated until the participant reached a pre-designated rehearsal performance criterion. The notable feature of this study was that the experimenters assessed skill maintenance; most previous studies using behavioral skills training have not assessed skill maintenance.

Thus far, only one study has used BST to train others to implement an oral care procedure (Graudins, Rehfeldt, DeMattei, Baker, & Scaglia, 2012). Graudins et al. used BST in

the form of instructions, video modeling, rehearsal, and feedback to teach three oral care providers to use differential reinforcement, escape extinction, and prompting with and without picture cards. These procedures were taught for use during oral exams and dental cleanings of children with ASD. Generalization probes during a novel oral care procedure, a bitewing x-ray, were also used to evaluate participants' incorporation of the trained behavior analytic techniques. All participants acquired the skills and displayed above-criteria performance in the use of these skills during post-training and generalization probes. The BST package used in the current study was modeled after the packages used in the Rosales et al. (2009) study and the Graudins et al. study due to the fact that Graudins and colleagues used a video model and Rosales and colleagues assessed skill maintenance.

The current study investigated the effects of BST on behavior management and prevention techniques with Dental Hygiene students providing dental cleanings to school-aged special needs patients. To be included as a "special needs" patient, individuals were either diagnosed with a developmental disability or under the age of 5. In dentistry and dental hygiene, special needs patients include very young children (those under age 5), individuals with disabilities, and the elderly, as these individuals have potential for uncooperative behavior, high barriers to care, inability to care efficiently for their own oral health, and other issues that create special oral health care needs (Special Care Dentistry Association, 2011).

CHAPTER 2

METHOD

Participants

Three senior dental hygiene students from the Dental Hygiene Program at Southern Illinois University Carbondale were randomly selected to participate. In order to select the participants, three numbers were chosen between 1 and 19 (inclusive) by the experimenter. The students with these numbers on the class list of those enrolled in a required course titled "Multicultural Applied Experience in Dental Hygiene" were contacted by the professor teaching the course and asked if they were interested in participating. Tina, Janice, and Amber participated. All participants had limited experience in providing dental care to patients with special needs but were enrolled to gain experience at a mandatory rotation site for the aforementioned course: a special school rotation where a "mobile clinic" was set up in several different special school buildings in rural school districts in southern Illinois, where the study took place. Participants reported experience with one to three patients with disabilities prior to the study. One participant has a sister with a developmental disability, but prior to the start of the study, none of the participants had received classroom lecture on how to treat patients with special needs and each participant had limited experience providing dental care procedures to individuals with special needs. Participants received approximately a total of 12 hrs of classroom lecture on ASD, patients in wheelchairs, and on developmental disabilities during the semester in which the study was conducted.

Children diagnosed with developmental disabilities and children under the age of 5 served as the patients. Diagnoses of patients included, but was not limited to, autism spectrum

disorder, Down syndrome, ID, cerebral palsy, and deaf or hard of hearing. All patients attended one of the four schools which the mobile clinic served. Prior to the study, all patients received a school dental exam which included a visual inspection of the teeth using a mouth mirror and dental explorer. All exams were conducted in a portable dental chair using a dental light and were performed by a dentist. Results of the exam were provided to the school nurse, the parents or caregivers, and included in the individual's dental record. During the exam, the behavior of each individual was scored as cooperative, needs improvement, or uncooperative. Patients assigned these ratings were randomly distributed across dental hygiene participants so that each participant was given roughly the same number of patients labeled cooperative, needs improvement, and uncooperative.

Setting and Materials

Behavioral Skills Training was provided to the participants within a dental hygiene classroom and mobile clinic. The group training sessions were held in a dental hygiene laboratory where a PowerPoint presentation was displayed on a laptop computer screen. Participants and other dental hygiene students serving as group members sat in chairs near the computer while the experimenter sat adjacent to the computer and provided verbal instructions.

Baseline, *in-vivo* training, and post-training data were collected in the mobile clinic. Dental chairs and all other materials were mobile and brought to several different special education school buildings in rural school districts in southern Illinois. One or two collapsible chairs without any motorized parts were set up in a room at each school. The chairs could manually recline when necessary, but began in the upright position. In cases when patients were in wheelchairs, dental procedures were attempted with the patient in their wheelchair. Collapsible and adjustable dental lights were used. A portable dental unit with a small generator

provided limited water and suction for the procedures. Clinicians utilized a mouth mirror and dental light to visually inspect for calculus. Dental explorers and debridement instruments were utilized when deemed necessary. Plaque was removed using debridement instruments, mechanical spin-brushes or manual toothbrushes. Calculus was removed with sterile debridement instruments. Participants attempted cleanings on individuals who returned a signed consent in four schools each. Prior to beginning treatment, participants reviewed each patient's medical history and parent or caregiver's comments regarding the individual's oral health history.

Throughout the mobile clinic, school staff retrieved children from their classrooms and brought them to the location of the mobile clinic. Patients were brought one or two at a time in order to fill the open chairs. The clinic director chose the top file from a pile marked "cooperative," "needs improvement," or "uncooperative" (described earlier), handed the file to a school staff member, and the child listed in that file was brought to the next available chair.

Study materials included a picture schedule on a double-sided board approximately 3 ft by 2 ft in size with 15 pictures total, toys, stickers, and bubbles which were used as reinforcers, and stickers and pencils which were used as rewards at the end of the child's treatment. Some ideas for reinforcers for the children were collected from teachers, individual and classroom aides, school nurses, and caregiver comments included in the medical history.

Experimental Design

A multiple baseline across participants design was used to evaluate the effects of the BST package. This is a common single subject design which uses repeated measures across several different individuals and throughout each phase, introduces the intervention only after stable

trends in measures have been gathered, and staggers the introduction of the intervention across participants to control for the effects of extraneous variables

Baseline sessions were conducted prior to the onset of the intervention. The first component of the intervention consisted of a group training session. Each participant participated in a separate group training session from the other participants. Other students from the Dental Hygiene Program comprised the rest of the training group. After the group training was completed, participants took part in individual *in-vivo* training sessions at the mobile clinic with patients with special needs and observed by the first author. The group training was introduced to each participant sequentially, after stable responding was observed during baseline. As one participant began to show skill acquisition above baseline levels during training, the next participant began training. After a participant attained mastery criteria during training, post-training sessions began in order to measure maintenance of the skills acquired during training in the absence of feedback.

Dependent Variables

There was one primary dependent variable and one secondary dependent variable. The primary dependent variable was the percentage of total steps on the task analysis completed correctly by the dental hygiene student. The secondary dependent variable was the percentage of steps attempted by the participant.

Independent Variable

The independent variable was a BST package including written instructions, verbal instructions, modeling, rehearsal, and feedback. This intervention package was intended to teach dental care providers how to implement the basic behavioral procedures of escape extinction, contingent escape, least-to-most prompting, and contingent and differential reinforcement, along

with the commonly used procedures of succinct instructions, picture schedules, and setting contingencies for use with special needs patients during dental care procedures. The written instructions were comprised of the task analysis checklists of the procedures that were to be carried out during the pre-cleaning and cleanings (including what to do during any challenging behavior). Verbal instructions consisted of a verbal presentation with an accompanying PowerPoint presentation which described the procedures of escape extinction, contingent escape, picture schedules, prompting, providing instructions, setting contingencies, and differential reinforcement, described the written instructions, and answered any questions about the written instructions. Modeling consisted of videos of the correct procedures being implemented by an oral care provider with children diagnosed with autism. Rehearsal consisted of the participants role-playing the steps of the procedures with the other students during the group training and *in-vivo* rehearsal of the steps of the procedures with special needs patients during the mobile clinic. Feedback consisted of verbal descriptions of the steps completed incorrectly (or steps skipped) and some of the steps completed correctly during both the group and *in-vivo* training, as well as graphic feedback of the percentage of steps attempted and the percentage of steps completed correctly during *in-vivo* training. Verbal and graphic feedback were provided immediately after rehearsal.

Response Measurement

Participants' responses were measured via a series of two training evaluation checklists delineating specific sets of steps targeted for intervention pertaining to the participants' behavior during the pre-cleaning and cleaning (shown in Appendix A). Also included was an alternative checklist delineating steps targeted for intervention in the event that a child displayed challenging behavior during a step of the pre-cleaning or cleaning checklists (shown in Appendix

B). These checklists were developed for a previous experiment (Graudins et al., 2012) and were revised by the first author for the current experiment. Challenging behavior was defined as behavior that prevented the oral care provider from continuing the procedure, such as moving the head, closing the mouth, crying, yelling, verbal refusal to complete any behavior, or aggression. If the child engaged in challenging behavior during the participant's completion of a step in the task analysis, the "Challenging Behavior Checklist" (Appendix B) was scored, assuming the participant completed the appropriate steps for challenging behavior before moving on through the dental procedures in the task analysis.

For each step in the training evaluation checklist or challenging behavior checklist, the experimenter recorded whether the step was performed correctly or incorrectly (or omitted) by the participant. If any part of a step was performed incorrectly or omitted, that step was recorded as incorrect. A correct step was defined as the participant performing the step exactly as written in the checklist.

The steps attempted by each participant were scored on the "Steps Attempted Checklist" (shown in Appendix C). For each step in the steps attempted checklist, the experimenter recorded whether the step was attempted or not attempted by the participant. If a step was attempted and performed correctly or performed incorrectly, a plus was recorded for that step. If a step was not attempted (i.e., omitted), a minus was recorded for that step.

Procedures

Baseline. Each participant was given a copy of the training evaluation checklists, challenging behavior checklist, and steps attempted checklist to read for up to 15 min prior to each baseline session. During baseline sessions, participants were told to complete the procedures to the best of her abilities and conduct the full pre-cleaning and cleaning with each patient. The experimenter did not provide the participants with any feedback nor provide any

help during the baseline sessions aside from reminding the participant to do what they thought was best if asked for any help/advice.

Training. Training consisted of verbal instructions, modeling, rehearsal, and feedback. Initial training consisted of a group training including one participant and an additional oral hygiene student not serving as a participant in the study. The group training included the delivery of verbal instructions explaining differential reinforcement, escape extinction, contingent escape, picture schedules, providing instructions, setting contingencies, and least-to-most prompting. These instructions were presented via a PowerPoint presentation approximately 45 min in length. Following the PowerPoint presentation, the first author described the steps delineated in the training checklists and informed the participants as to what to say and do during each step in the training checklists and how to perform basic behavior analytic techniques used to work through and prevent challenging behavior. Following the instructional portion, participants viewed a 12 min video model of a skilled oral care provider performing the steps in the training checklists and managing challenging behaviors. After viewing the video model, participants role-played the steps in the training checklists with the other dental hygiene student attending the group training. Immediately following each role-play, participants were provided with verbal feedback using the training checklists in which they were told which steps they had performed correctly, which steps they had performed incorrectly, and what to do to perform the incorrectly performed steps correctly, the percentage of steps completed correctly, and the percentage of steps attempted. Role-play and feedback continued until the participant completed 90% of steps correctly in one attempt. (The group training including all components—instructions, modeling, rehearsal, and feedback—lasted 2.5 hrs for Tina, 2.75 hrs for Amber, and 2.5 hrs for Janice.)

After the completion of the group training, the second training portion began within the mobile clinic environment (*in-vivo* training). During *in-vivo* training, the participants rehearsed their new skills and techniques learned during the group training *in-vivo* with various special needs patients at the mobile clinic. Prior to each session, each participant was: given a copy of the training checklists to read for up to 15 min, told to complete the procedures to the best of her ability and conduct the full pre-cleaning and cleaning with each patient, and reminded of the mastery criteria—90% of steps completed correctly with the full training checklist completed across two consecutive sessions. Immediately following each session, verbal feedback was provided to participants on the percentage of steps attempted, the percentage of steps completed correctly, some of the steps the participant completed correctly, and the steps completed incorrectly or omitted. At this time, graphical feedback was also provided to participants on the percentage of steps attempted and the percentage of steps completed correctly. Participants who did not attempt all training steps (did not attempt to complete pre-cleaning or cleaning with a child) were prompted to attempt to complete the full pre-cleaning/cleaning with the next child. The experimenter did not provide any help during the training sessions aside from reminding the participant to do what they thought was best and a reminder, if necessary, that the participant could stop the session when they felt they were done with the patient's dental care procedures. Participants continued to rehearse the skills *in-vivo* and receive feedback until they completed at least 90% of the steps correctly across two consecutive sessions while attempting 100% of steps.

Post-training. Post-training sessions were identical to baseline sessions.

Interobserver Agreement. Interobserver reliability data were collected by two trained graduate students for 35% of all sessions. An agreement was defined as both observers recording a plus, minus, or N/A on a given step of the training evaluation checklist, challenging behavior

checklist, or steps attempted checklist. Interobserver agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements, and then converting this ratio to a percentage. The mean percentage of agreement across all experimental phases for the steps completed correctly was 84.6% (range, 71% to 98%) while the mean percentage of agreement across all experimental phases for the steps attempted was 95.1% (range, 84% to 100%).

Procedural Integrity. The integrity of the implementation of the procedures was evaluated using a procedural integrity checklist designed specifically for this study (Appendix C). Procedural integrity was scored as a percentage of steps correct on the procedural integrity checklist for all of the procedural components. The mean percentage correct across all experimental phases was 98% (range, 67% to 100%).

CHAPTER 3

RESULTS

Figure 1 depicts the percentage of steps completed correctly and the percentage of steps attempted by all three participants during baseline, *in-vivo* training, and post-training sessions.

Baseline

Participants scored under 35% correct during baseline and scores of steps attempted ranged from 39 to 88%. Tina attempted an average of 70% of steps during baseline (range: 58%-84%) and her mean level of correct responding was 17% (range: 11%-21%). The challenging behavior checklist was scored during only one of Tina's three baseline sessions and this checklist was scored three times during that one session.

Amber attempted an average of 63% of steps during baseline (range: 39%-83%) and her mean level of correct responding was 19% (range: 11%-27%). The challenging behavior checklist was scored during two of Amber's five baseline sessions and this checklist was scored one time during the first session and two times during the final session.

Janice attempted an average of 72% of steps during baseline (range: 53%-88%) and her mean level of correct responding was 21% (range: 9%-34%). The challenging behavior checklist was scored during five of Janice's seven baseline sessions. This checklist was scored one time during the first and third sessions, three times during the second session, and two times during the fifth and sixth baseline sessions.

Training

During group training, Tina, Janice, and Amber each scored above 90% on their third role-play attempt. After group training, participant's scores increased to over 50% correct and

quickly increased to over 90% correct during *in-vivo* training. Specifically, Tina scored above 65% correct in all *in-vivo* training sessions, also scoring 100% steps attempted on all but one training session. Tina reached training criteria after eight *in-vivo* training sessions. The Challenging Behavior Checklist was scored during four of Tina's eight *in-vivo* training sessions. This checklist was scored one time during the third and sixth training sessions, three times during the second training session, and six times during the fourth training session.

Amber reached training criteria on her third *in-vivo* training session. This means that after one session with 54% accuracy and 91% of steps attempted, Amber's accuracy increased to at least 90% and she attempted 100% of steps. The challenging behavior checklist was scored during only one of Amber's three *in-vivo* training sessions and this checklist was scored two times during that one session.

Finally, Janice reached training criteria on her third *in-vivo* training session as well. After one session with 76% correct and 88% of steps attempted, Janice had a perfect session where she not only attempted all steps, but she correctly completed 100% of steps on the Training Evaluation Checklist and met training criteria during the next *in-vivo* training session. The Challenging Behavior Checklist was scored during two of Janice's three *in-vivo* training sessions. This checklist was scored two times during the first training session and four times during the second training session.

Post-training

During post-training, participants maintained most of the skills learned during training, scoring well over baseline levels. Tina completed two post-training sessions at 88 and 89% accuracy with 100% of steps attempted. The Challenging Behavior Checklist was not scored during either of Tina's post-training sessions.

Janice completed two post-training sessions at or above 90% accuracy with 100% steps attempted. The Challenging Behavior Checklist was not scored during either of Janice's post-training sessions.

Unlike the other two participants, Amber completed four post-training sessions, but her accuracy dropped below 90% for the final three sessions with less than 100% of steps attempted as well. The Challenging Behavior Checklist was scored during only one of Amber's four post-training sessions. This checklist was scored one time during the final post-training session.

The results showed that 43% of patients displayed challenging behavior during the participants' completion of the Training Evaluation Checklist. Of the patients who displayed challenging behavior during the Training Evaluation Checklist, 62.5% of patients displayed more than one instance of challenging behavior.

CHAPTER 4

DISCUSSION

The results suggest that BST is an effective intervention for rapidly teaching basic behavioral techniques to dental hygiene students. While some participants attained mastery criteria more rapidly than others, all participants performed with much higher accuracy relative to baseline levels immediately after the group training and later attained mastery criteria during *in-vivo* training after three to eight *in-vivo* training sessions. Post-training results showed that participants maintained their skills in the absence of feedback.

A clear, functional relationship was revealed between the intervention and the participants' accuracy on the Training Evaluation Checklist. This is shown by both replication logic and time-series logic. Replication logic in this study's design assumes that any effect of the intervention shown in the treatment condition for the data from the first participant is again displayed in the treatment condition for the data from the second and third participants. This pattern is clear across all three participants; accuracy increased above baseline levels immediately in the *in-vivo* training condition and remained high for all participants. Time-series logic in this study's design assumes that steady state responding would continue if there was no change in the independent variable. This can be seen in the baseline condition for the data for all three participants; steady or decreasing scores were measured from all participants. Furthermore, each participant continued to show steady baseline scores after the previous participant began training. While threats to internal validity can never truly be ruled out, the likelihood of extraneous variables causing the drastic change in participants' performance is low while the

likelihood that the intervention was the cause of the increased accuracy for all three participants is high due to replication and time-series logic.

Some interesting conclusions follow from the training data. First, the group training sessions for all three participants lasted under 3 hours, suggesting that dental hygiene students could realistically be taught many of the skills necessary for working with special needs patients in one 3-hr class period. Sturmey (2008) suggested that the didactic instruction component of behavioral skills training could effectively be 2 to 5 min in duration. The data from the *in-vivo* training sessions (see Figure 1) suggest that some further rehearsal with the target population is necessary (after group training role-play and feedback) to fully acquire the behavior management and prevention skills taught. Second, while the current data suggest that eight or more rehearsal sessions with the target population may be necessary to fully acquire the skills for some dental hygienists, it is important to note that *in-vivo* training sessions did not include any modeling or concurrent feedback. Skills may increase to mastery criterion more rapidly than during that of the current study if a trained observer provides a model, concurrent feedback, or some other assistance to the dental hygienist in training during the patient's visit (i.e., each *in-vivo* training session).

While data were not collected on the number of steps with challenging behavior displayed by patients, the number of occurrences can be roughly ascertained by the number of times each participant was scored on the Challenging Behavior Checklist. However, this checklist was only scored for instances of challenging behavior that occurred within a step on the Training Evaluation Checklist. Therefore, patients could have engaged in challenging behavior when the participant was engaging in other, non-checklist related behavior (e.g., applying fluoride varnish, handing the patient the toothbrush for them to show their skill level, continuous

scaling after the steps for scaling on the checklists had already been scored, etc.). The aforementioned measure was deemed the best way to measure occurrences of challenging behavior while keeping the focus of the study on the participants and not their patients. Overall, only about one-fourth (27%) of all patients displayed challenging behavior more than once during the participants' completion of the Training Evaluation Checklist. Therefore, challenging behavior was fairly minimal throughout the study, only being displayed by less than half of the patients. While it is not possible to know whether the procedures were actually effective in preventing challenging behavior, some of our data may give us some brief insight on the topic (not to mention that previous research in behavior analysis has established the behavioral techniques used as effective for decreasing challenging behavior). A few patients were seen more than once during the study, with none being seen more than three times. One patient who was seen three times displayed less occurrences of challenging behavior during the first two (baseline) sessions than during the third (training) session. However, during the third session, the participant attempted 20% more steps than during the highest baseline session in which this patient was seen. Therefore, during the third session, there were more steps presented to the patient for which he could display challenging behavior and the patient escaped a fewer proportion of tasks during this session than either of the baseline sessions. Furthermore, another patient who was seen twice (first during baseline and second during training) displayed no challenging behavior during baseline and one instance of challenging behavior during training. Similarly, the participant attempted over 40% more steps during the training session than the baseline session and the step during which challenging behavior occurred was not attempted during the baseline session in which the patient had been seen.

While this study mirrored Graudins et al. (2012) in many ways, there are four main ways this study differs. First, the type of patients seen overlapped across the two studies but, in the current study, not all patients were diagnosed with autism. Furthermore, while the Graudins et al. study exclusively used children between the ages of 3 and 7 as patients, the current study used individuals between the ages of 3 and 22. Participants may have had to modify their behavior more than those in the Graudins et al. study due to a wider range of ages, functioning level, barriers to care (some individuals were in wheelchairs, some individuals had medically fragile conditions, some individuals were deaf, etc.), and disabilities. Second, the setting was entirely different between the two studies. Graudins et al. study was conducted in a clinic room at the Community Dental Center, set up with dental chairs and equipment similar to a typical dental environment (i.e., the average dental office). The current study was conducted in public schools with all mobile equipment including collapsible chairs, lights, and a unit for water, air, and suction which used a loud generator to work and only provided limited water and suction use. In fact, outside of the study sessions, this unit was infrequently used because it worked so poorly and the dental hygiene students used gauze or asked high-functioning patients to spit into a trash can if necessary. Equipment challenges and working in a new environment likely created additional problems for the participants aside from working with a new population. Third, the setting of Graudins et al. had a rule/policy against allowing excessive noise (especially screaming) from patients which may have caused one of several things to happen: If a child was screaming or crying, the dental hygienists would have to try to get the child to stop or they would have to leave, which could have reinforced this behavior for some patients. Additionally, the authors noted that the participants may have avoided attempting steps that were likely to elicit such disruptive behavior as screaming or crying because they knew the Center policy against

allowing screaming. This rule/ policy was a limitation of the Graudins et al. study that the current study attempted to overcome. Consequently, the current study had no such rule. In fact, the nurses at the special schools reported that most students and staff within each school were accustomed to noise/screaming; therefore, any patient screaming during a dental visit did not disrupt classes or other usual routines. Fourth, the checklists used in the current study were revised from the versions used in the Graudins et al. (2012) study. While the Graudins et al. checklists frequently had explicit sentences that participants were supposed to use, the current study removed these and allowed for more spontaneous and generalized instructions to be used. The reason for many of the changes was that it was important to teach participants concepts, not scripts—it was assumed that a wide variety of instructions would suffice and that the current study was not meant to teach participants to be robotic with their patients, but more to apply what they learned to all situations/patients and be their own, unique selves.

School-based dental services are frequently described as an extremely advantageous means to care—possibly more advantageous than private or other community-based dental centers. Dunning and Dunning (1978) point out 10 advantages of school-based dental clinics, including higher utilization of dental care services than by any other method, clinics being less threatening to children than private offices, the location facilitates dental health education, and higher proportions of low-income individuals receiving care, among others. Jenkins and Geurink (2006) call school-based oral health programs "an ideal mechanism to provide care to children in need" (p. 1) and similar statements were provided by McCombs, Gadbury-Amyot, Wilder, Skaff, and Green (2007), Simmer-Beck et al. (2011), and DeMattei, Allen, and Goss (2012).

Common barriers to receiving dental care reported by parents include cost, transportation, language, lack of providers, inability for parents to take off work, and lack of information

(Simmer-Beck et al., 2011). Simmer-Beck and colleagues noted that another study reported comparable barriers and claimed that school- and community-based models circumvent many of these barriers. Barriers that may have been circumvented during the current study include cost, transportation, parents needing to take off work, lack of providers, and language (the nurse interpreted for the children who used American Sign Language). Among the research concerning school-based dental care, the consensus appears to be that it is beneficial and necessary to reach a higher proportion of children, especially those from families of low income or for whom access to health/dental care is difficult.

While creating school-based dental clinics in all school districts in the U.S. appears to be an insurmountable feat, several other countries have done just that and report much higher proportions of children receiving dental care (in the 1970s). According to Dunning and Dunning (1978), 95% of children in Sweden received school-managed dental care through a government program and 98% of children in New Zealand utilized school-based dental services at the time the article was written. At the same time, school-based clinics in the U.S. were "infrequent, poorly financed, [and] poorly equipped for the most part" (Dunning & Dunning, p. 664). At the same time, less than 50% of children in the U.S. were reported to receive comprehensive periodic dental care. Dunning and Dunning describe that the majority of U.S. children receiving dental care are transported to private dental offices, typically taken out of school to do so, and many Medicaid patients are turned away due to reluctance of accepting Medicaid reimbursement by private dentists. In 1973, the Advisory Committee on Dental Health to the U.S. Department of Health, Education, and Welfare recommended "careful study and evaluation of all aspects of a school-based children's dental care program" (p. 664). One can see while looking at the current state of affairs in the U.S. that progress on this recommendation made nearly 40 years ago has

been slow, or at least widespread use of school-based dental care programs has not occurred despite positive results in research and positive attitudes toward school-based dental care programs. In fact, as more and more schools hire board certified behavior analysts, there may be a role for such staff assisting with school-based oral health-care routines on a regular basis.

The response of the participants has been very positive. Each participant has been observed on many occasions either telling the experimenter personally or telling others the benefits of being involved in the study. Some benefits they've listed include increased confidence for working with children and individuals with disabilities, better challenging behavior prevention strategies, better behavior management strategies, and attaining increased cooperation from patients outside of the study setting. Two participants and two other senior dental hygiene students were observed discussing the great utility they see in having and using picture schedules, wanting to make and use one in future clinics where they will be employed, and a suggestion to a dental hygiene faculty member that creating a visual schedule should be a class assignment (one which they would enjoy and find very helpful for future use).

According to Simmer-Beck et al. (2011), dental and dental hygiene students are more likely to later seek out employment in alternative practice settings and with patients that lack access to care if they receive experience in these areas. Not only have the participants in the current study gained experience in these areas, but the above comments made by the participants make it likely that dental hygiene students receiving similar training on behavior management and prevention techniques will be more likely than students not receiving such experience to seek out employment opportunities where they will work with a population with whom the hygienist could use their skills.

In a study conducted by Keselyak, Simmer-Beck, and Gadbury-Amyot (2011), dental hygiene students who gained experience in a school-based dental clinic wrote journal entries describing their experiences in the clinic. Upon review of the journals, themes that emerged fell under five main categories: skill development, awareness, type of experience, description of environment/setting, and role model. Taken together, participants' journal entries suggested that students found the school-based dental clinic experience "helpful in further developing their dental hygiene skills, creating an awareness of the needs and disparities within their communities, developing an appreciation for new models of care delivery and finding personal satisfaction in caring for those in need of their professional skills" (Keselyak et al., p. 201).

Several limitations exist for the current study. First, participant acceptance of the intervention was not evaluated formally. While many anecdotal comments were recorded with their permission, it is unclear whether responses would have differed if participants were able to evaluate the intervention anonymously. Second, the amount of challenging behavior each participant was exposed to during the study's sessions could not be controlled. However, steps were taken to attempt to control for the challenging behavior displayed by patients of each participant by assigning participants a similar number of patients given each cooperation rating during their dental exam prior to the study. Despite these attempts, participants did not receive equal challenging behavior experiences. Additionally, sessions where patients did not display any challenging behavior involved completing fewer steps for the participants and thus, involved fewer steps that needed to be completed correctly. In this way, it appears that providing a cleaning for patients who did not display any challenging behavior was truly easier to complete correctly. Third, one participant needed five more *in-vivo* training sessions to reach mastery criteria than the other two participants. Consequently, it seems that modifications to the training

package may be essential if this package were to be adopted for training programs. Fourth, the current study did not perform a component analysis. There is still a great need for analyzing which components of BST are necessary and effective.

Despite these limitations, this study extended prior research in at least four important ways. First, this study will add to the current BST literature, showing not only another successful training package, but also that much of this training can be performed in a natural setting where students were already gaining experience at a clinic rotation site. Second, the current study (along with the Graudins et al. (2012) study) extends the uses of BST to the training of behavior management and prevention procedures for dental hygiene students. Third, the current study will greatly add to the dental training/education literature for methods of effectively teaching behavior management and prevention techniques to students. Fourth, the setting of this study helps extend the literature on school-based dental care, showing that school-based dental care is a great possibility for reaching not only typically developing children, but children diagnosed with developmental disabilities as well.

While many avenues for future research now present themselves, the current study points to three main avenues future research could follow next. First, future research could explore the length/amount of the instructional portion of the BST package that is necessary to increase skill levels. Sturmey (2008) suggests that the instructional portion could be as short as 2-5 min in length. The current study allowed participants to read the training checklists, the challenging behavior checklist, and the steps attempted checklist for 15 min prior to every session, including baseline. While the instructions component of the group training provided in the current BST package provided more background information on the actual behavior analytic procedures underlying the checklists during the group training, it seems possible that none of the

instructional portion of the BST package had any effect on participant behavior. Alternatively, perhaps the instructional portion during group training, which was at least 45 min in length, could have been reduced to 5 min in length and had similar effects on participant behavior. Second, future research should continue to investigate which component of BST is most effective. It is unclear whether all components are necessary and have some effectiveness or if some could be left out altogether. For example, the instruction portion is frequently perceived as being the least effective component in BST; this is probably due to typical approaches to staff training which utilize verbal instructions only and later have little to no effect on actual participants' behavior in real-life situations (Sturmey). While the instruction and modeling components cannot be divided and examined separately in the current study, their effectiveness together can be considered. The scores from the first role play attempt during group training may reflect the effectiveness of the instructions and modeling components of the current BST package. Amber performed with 75% accuracy and attempted 94% of steps in her first role-play attempt, Tina performed with 68% accuracy and attempted 95% of steps in her first role-play attempt, and Janice performed with 30% accuracy and attempted 67% of steps in her first role-play attempt. Interestingly, Janice's performance did not increase in either accuracy or steps attempted from baseline levels while Amber and Tina's performances both increased greatly in both accuracy and steps attempted from baseline levels. Therefore, for at least two of the three participants, it appears that the grouping of instructions and modeling increased participants' performance over baseline levels (during role-plays). Further investigation is needed to support or refute this hypothesis, however. Third, future research should investigate the effectiveness of the current procedures for training larger groups of dental hygiene students (i.e., a whole classroom). While the current study trained three dental hygiene students to an accuracy

criterion, it seems that training larger groups would be more economical and time-efficient. While this study strived to examine individual differences in three participants, it would save time and effort if larger groups were trained at once (the current study utilized three separate nearly 3-hr 'group' training sessions before beginning *in-vivo* training for each participant). If a single 3-hr training session could train even 12 students at once, it would double the number of students seen in one-third the total time. The only drawbacks to that model would be finding trainers to observe role-plays and provide effective feedback or training the trainees to reliably collect data and provide feedback on other trainees' role-play performances.

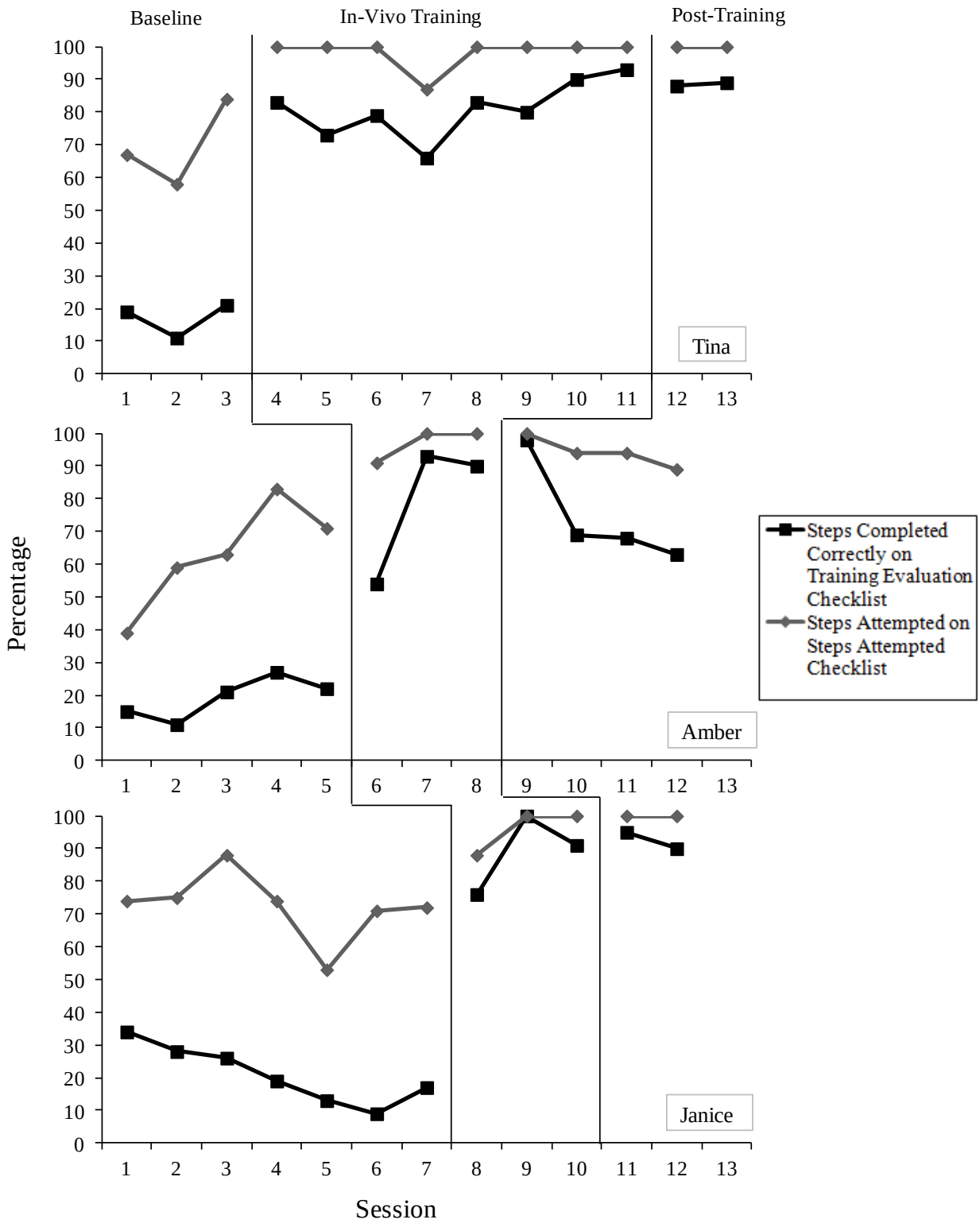

Figure 1. The percentage of steps completed correctly and steps attempted for Tina, Amber, and Janice during Baseline, In-Vivo Training, and Post-Training.

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APPENDICES

APPENDIX A

TRAINING EVALUATION CHECKLIST

Prior to Child's Arrival

Step #	Task	+/-
1.	Does the clinician have potential preferred items ready?	
2.	Does the clinician have a visual schedule and necessary tools ready and set up?	

Pre-Cleaning

Step #	Task	+/-
1.	After teacher brings child to dental area, Clinician greets child and engages the child in play (by setting out toys on the floor or dental chair) or casual conversation	
2.	Clinician lets child play/talk for approximately 1 minute	
3.	Clinician obtains child's attention and goes over the visual picture schedule	
4.	Clinician succinctly instructs child to sit in the CHAIR	
5.a.	Clinician gives behavior-specific praise and/or reward for compliance	
5.b.	If child not compliant, Clinician continues to steps for challenging behavior first, then goes on to step 6	
6.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
7.	Clinician gives GLASSES to child and succinctly instructs child to put them on	
8.a.	Clinician gives behavior-specific praise and/or reward for compliance	
8.b.	If child not compliant, Clinician continues to steps for challenging behavior first, then goes on to step 9	
9.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
10.	Clinician succinctly labels the LIGHT while turning it on	
11.	Clinician gives behavior-specific praise for tolerating the light	
12.	Clinician shows child BIB and succinctly tells the child what they will do with it while putting it on the child	
13.a.	Clinician gives behavior-specific praise and/or reward for tolerating the bib	
13.b.	If child not compliant, Clinician continues to steps for challenging behavior first, then goes on to step 14	
14.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
15.	Clinician shows child MASK AND GLOVES and succinctly tells the child what they will do with them	
16.	Clinician gives behavior-specific praise for tolerating the mask and gloves	
17.	Clinician succinctly instructs child to LEAN BACK	
18.a.	Clinician gives behavior-specific praise and/or reward for compliance	
18.b.	If child not compliant, Clinician continues to steps for challenging behavior first, then goes on to step 19	

19.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	

Cleaning

Step #	Task	+/-
1.	Clinician shows child mouth MIRROR and succinctly tells the child that it goes in their mouth	
2.	Clinician succinctly instructs child to open mouth and puts mouth mirror in briefly	
3.a.	Clinician gives behavior-specific praise and/or reward for compliance	
3.b.	If child not compliant, Clinician continues to steps for challenging behavior first, then goes on to step 4	
4.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
5.	Clinician succinctly instructs child to open their mouth while the Clinician counts to a certain number (i.e., 5, 10), then puts mouth mirror in mouth	
6.a.	Clinician gives behavior-specific praise and/or reward for compliance to the final number	
6.b.	If child not compliant at all, Clinician continues to steps for challenging behavior first, then goes on to step 7	
6.c.	If child not compliant to the final number, Clinician takes breaks while counting teeth and gives behavior-specific praise in between. On subsequent attempts, Clinician counts to a lower number -Continue to steps for challenging behavior first, then go on to step 7	
7.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
8.	Clinician shows child mouth mirror and EXPLORER (or acceptable replacement) and succinctly tells the child these items go in the child's mouth	
9.	Clinician succinctly instructs the child to open mouth and puts mouth mirror and explorer in for a brief moment	
10.a.	Clinician gives behavior-specific praise and/or reward for compliance	
10.b.	If child not compliant, Clinician continues to steps for challenging behavior first, then goes on to step 11	
11.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
12.	Clinician succinctly instructs child to open their mouth while the Clinician counts to a certain number (i.e., 5, 10), then puts mouth mirror and explorer in mouth and begins to count or scale teeth	
13.a.	Clinician gives behavior-specific praise and/or reward for compliance to the final number	
13.b.	If child not compliant at all, Clinician continues to steps for challenging behavior first, then goes on to step 14	
13.c.	If child not compliant to final number, clinician takes frequent breaks while exploring teeth and gives behavior-specific praise in between. On subsequent attempts, Clinician counts to a lower number	

	-Continue to steps for challenging behavior first, then go on to step 14	
14.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
15.	Clinician repeats steps 12-14 until finished with exploring or scaling	
16.	Clinician shows child POLISHER/BRUSH and succinctly tells the child that it goes in their mouth	
17.	Clinician succinctly instructs the child to open mouth and puts polisher/brush in for a brief moment	
18.a.	Clinician gives behavior-specific praise and/or reward for compliance	
18.b.	If child not compliant, Clinician continues to steps for challenging behavior first, then goes on to step 19	
19.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
20.	Clinician succinctly instructs the child to open their mouth while the Clinician counts to a certain number (i.e., 5, 10), then puts polisher in mouth and begins to polish around each tooth	
21.a.	Clinician gives behavior-specific praise and/or reward for compliance to final number	
21.b.	If child not compliant at all, Clinician continues to steps for challenging behavior first, then goes on to step 22	
21.c.	If child not compliant to final number, clinician takes frequent breaks while polishing teeth and gives behavior-specific in between. On subsequent attempts, Clinician counts to a lower number -Continue to steps for challenging behavior first, then go on to step 22	
22.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
23.	Clinician shows child WATER AND SUCTION TOOLS and succinctly tells the child that they go in their mouth	
24.	Clinician succinctly instructs the child to open mouth and puts water and suction tools in	
25.a.	Clinician gives behavior-specific praise and/or reward for compliance	
25.b.	If child not compliant, Clinician continues to steps for challenging behavior first, then goes on to step 26	
26.	Clinician repeats steps 20-25 until finished with polishing	
27.	Clinician shows child FLOSS and succinctly tells the child that it goes in their mouth	
28.	Clinician succinctly instructs child to open mouth while the Clinician counts to a certain number, then puts floss in mouth and begins to floss between each tooth	
29.a.	Clinician gives behavior-specific praise and/or reward for compliance to final number	
29.b.	If child not compliant at all, Clinician continues to steps for challenging behavior first, then goes on to step 30	
29.c.	If child not compliant to final number, clinician takes frequent breaks while flossing teeth and gives behavior-specific praise in between. On subsequent attempts, Clinician counts to a lower number -Continue to steps for challenging behavior first, then go on to step 30	

30.	If applicable, Clinician lets child play with reward for a few seconds, then succinctly instructs child to give it back	
31.	Clinician repeats steps 28-30 until finished with flossing	

End of Appointment

Step #	Task	+/-
1.	Clinician provides general praise and informs child they are finished	
2.	Clinician gives child a reward to take home by handing one to the child or letting child pick from several options (i.e., 2 options, the full contents of the bag)	

Total Number of +: _____

Total Number of Steps Scored: _____ Session Percentage: _____

APPENDIX B

CHALLENGING BEHAVIOR CHECKLIST

If **challenging behavior** occurs throughout any step of either pre-cleaning or cleaning: (complete one of these evaluation forms for any step of either TA during which problem behavior is exhibited)

Step #	Circle: PRE-CLEANING or CLEANING Step #: _____ Task	+/-
1.	Clinician shows child picture schedule, describing "first (work), then (reward item)"	
2.	Clinician shows child a picture card while describing what will happen and what to do, and demonstrates if possible	
3.	Clinician prompts child to comply with given task with a verbal prompt (i.e., say "get in chair")	
4.	Clinician prompts child to comply with given task with a gestural prompt (i.e., point to chair while saying "get in chair")	
5.	Clinician prompts child to comply with given task with a physical prompt (i.e., physically guiding child toward chair while saying "get in chair")	
6.	Clinician withholds reinforcers (reward and escape) from child until compliance occurs and continues procedure if possible	
7.	If challenging behavior does not stop within 3 minutes, clinician allows the child to hold on to a preferred item throughout procedures, while continuing to present and remove a different preferred item	
8.	Clinician immediately gives behavior-specific praise and/or reward to child after increased compliance	
9.	If challenging behavior still does not stop after step 7, the clinician returns to the last step of the procedure that was done with compliance and repeats those instructions, then the clinician moves on to the next step in the procedure OR ends the session after that step is repeated (to end on a good note).	

APPENDIX C

STEPS ATTEMPTED CHECKLIST

Pre-Cleaning

Step #	Task	+/-
1.	Greet child upon entering exam room	
2.	Offer child toys to play with in the 'exam' room next to chair or talk with child	
3.	Tell child to sit in the chair	
4.	Tell child to put on glasses	
5.	Show child the light	
6.	Put bib on child	
7.	Show child Clinician's mask and gloves	
8.	Tell child to lean back in the chair	

Cleaning

Step #	Task	+/-
1.	Tell child to open mouth	
2.	Place mouth mirror in child's mouth	
3.	Place explorer-like object in child's mouth	
4.	Count or scale child's teeth	
5.	Tell child to open mouth	
6.	Put polisher/brush in child's mouth	
7.	Polish/brush around each tooth	
8.	Put water syringe and saliva ejector in mouth	
9.	Rinse and suction in child's mouth	
10.	Put floss in child's mouth	
11.	Floss around each tooth	

Total Number of +: _____

Total Number of Steps Scored: _____ Session Percentage: _____

APPENDIX D

PROCEDURAL INTEGRITY

Date: _____ Participant: _____ Session #: _____

Baseline / Post-training (circle one)

	Yes	No
1. Prior to the session, participant was given a copy of the training checklists to read for up to 15 min		
2. Prior to the session, participant was told to complete the procedures to the best of their abilities		
3. Prior to the session, participant was told to conduct a full exam and cleaning		
4. Experimenter did not provide feedback on the participant's performance		
5. Experimenter did not remind the participant of any forgotten steps		
6. Experimenter did not provide any help aside from reminding the participant to do what they thought was best		

Total Yes: _____ / 6 = _____%

In-vivo Training

	Yes	No
1. Prior to the session, participant was told that the mastery criteria is 90% of steps completed correctly with the full training checklist completed across 2 consecutive sessions		
2. Prior to the session, participant was told to complete the procedures to the best of their abilities		
3. Prior to the session, participant was told to conduct a full exam and cleaning		
4. Immediately following the session, experimenter provided verbal feedback on the percentage of steps attempted and the percentage of steps completed correctly		
5. Immediately following the session, experimenter provided graphical feedback on the percentage of steps attempted and the percentage of steps completed correctly		
6. Experimenter did not provide any help during the session aside from reminding the participant to do what they thought was best		
7. If participant did not attempt all training steps, experimenter told participant to complete the full exam/cleaning with the next child		

Total Yes: _____ / 7 = _____%

Procedural Integrity

Date: _____ Participant: _____

Group Training

	Yes	No
1. Provided instructions to participants via the full PowerPoint presentation		
2. Answered the participants' relevant questions		
3. Showed the video model		
4. Explained role-play and criteria to reach: 100% accuracy during 1 role-play		
5. Immediately following role-play, provided verbal feedback using the training checklists on steps performed correctly		
6. Immediately following role-play, provided verbal feedback using the training checklists on steps performed incorrectly		
7. Told participants what to do to perform the incorrect steps correctly, if needed		
8. Prompted participants to continue role-play until they reach 100% accuracy during 1 role-play		

Total Yes: _____ / 8 = _____%

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